CLAIMS:

1. A method of controlling a process in a semiconductor manufacturing system, comprising:

setting process control input data for said process in said semiconductor manufacturing system;

measuring process control output data from said process in said semiconductor manufacturing system;

determining a relationship between said process control output data and said process control input data;

setting target process control output data to a target result of the process; and

calculating new process control input data by minimizing a difference between said target process control output data and predicted process control output data, wherein said predicted process control output data is determined using said relationship applied to said new process control input data.

2. The method as recited in claim 1, further comprising:

updating said relationship between said process control input data and said process control output data.

3. The method as recited in claim 2, wherein said updating said relationship comprises:

using an exponentially weighted moving average (EMWA) filter.

4. The method as recited in claim 1, wherein said calculating comprises:

weighing said process control input data prior to calculating said new process control input data.

5. The method as recited in claim 1, wherein said calculating comprises:

weighing said process control output data prior to calculating said new process control input data.

6. The method as recited in claim 1, further comprising:

minimizing a difference between said process control input data and said new process control input data.

7. The method as recited in claim 1, wherein said determining comprises:

developing said relationship with a process model developed using partial least squares (PLS) analysis.

8. The method as recited in claim 1, determining comprises:

developing said wherein said relationship with a multiple input multiple output (MIMO) process model.

9. The method as recited in claim 8, wherein said developing further comprises:

developing an MIMO process model characterized by $\underline{Y} = f(\underline{X}) + \underline{C}$, wherein $\underline{Y}$ comprises process control output data, $\underline{X}$ comprises process control input data, $\underline{C}$ comprises an array of constants, and $f(\ )$ represents a function of $\underline{X}$.

10. The method as recited in claim 9, wherein said function $f(\ )$ represents a linear function.

11. The method as recited in claim 9, wherein said function $f(\ )$ represents a nonlinear function.

12. The method as recited in claim 1, wherein said setting comprises:

setting said process input data for an etch process.

13. The method as recited in claim 1, wherein said setting comprises:

setting said process control input data for least one of a RF power, a pressure, a fluid flow rate, a temperature, a rotation rate, and a composition.

14. The method as recited in claim 13, wherein said setting said process control input data comprises:

setting said process control input data including at least one of a RF power, a pressure, a C_4F_8 flow rate, a CO flow rate, and a O_2 flow rate.

15. The method as recited in claim 1, wherein said measuring process control output data comprises:

measuring said process control output data including at least one of a critical dimension, a slope, a profile, an etch rate, an etch depth, a deposition rate, and a film thickness.

16. The method as recited in claim 15, wherein said measuring process control output data comprises:

measuring at least one of a critical dimension at the top of a trench, a critical dimension at the bottom of the trench, a slope of the sidewall of the trench, a critical dimension at the top of a contact, a critical dimension at the bottom of the contact, and the slope of the sidewall of the contact.

17. The method as recited in claim 1, wherein said calculating comprises:

minimizing said difference using a Newton-Rhapson technique.

18. A control system for controlling a process in a semiconductor manufacturing system, comprising:

a process tool controller configured to be coupled to a process tool for executing said process,

said process tool controller further comprises,

a process recipe controller configured to set and adjust process control input data for said process, and set target process control output data to a target result of the process, and

a process model coupled to said process recipe controller and configured to provide a relationship between said process control input data and said process control output data,

wherein said process recipe controller is configured to generate new process control input data by minimizing a difference between said target process control output data and process control output data predicted by said relationship applied to said new process control input data.

19. The system as recited in claim 18, further comprising:

a metrology tool coupled to said process tool controller and configured to be coupled to said process tool,

said metrology tool is configured to measure process control output data for said process and provide said measured process control output data to said process tool controller for updating said process model.

20. The system as recited in claim 19, wherein said process tool controller is configured to update said process model using an exponentially weighted moving average (EWMA) filter.

21. The system as recited in claim 1, wherein said process model comprises partial least squares (PLS) analysis.

22. The system as recited in claim 1, wherein said process model comprises a multiple input multiple output (MIMO) process model.

23. The system as recited in claim 22, wherein said MIMO process model is characterized by $\underline{Y} = f(\underline{X}) + \underline{C}$, wherein $\underline{Y}$ comprises process

control output data, $\underline{X}$ comprises process control input data, $\underline{C}$ comprises an array of constants, and $f(\ )$ represents a function of $\underline{X}$.

24. The system as recited in claim 23, wherein said function $f(\ )$ represents a linear function.

25. The system as recited in claim 23, wherein said function $f(\ )$ represents a nonlinear function.

26. The system as recited in claim 18, wherein said process comprises an etch process.

27. The system as recited in claim 18, wherein said process control input data comprise at least one of a RF power, a pressure, a fluid flow rate, a temperature, a rotation rate, an a composition.

28. The system as recited in claim 27, wherein said process control input data comprises at least one of a RF power, a pressure, a C_4F_8 flow rate, a CO flow rate, and a O_2 flow rate.

29. The system as recited in claim 18, wherein said process control output data comprise at least one of a critical dimension, a slope, a profile, an etch rate, an etch depth, a deposition rate, and a film thickness.

30. The system as recited in claim 29, wherein said process control output data comprises at least one of a critical dimension at the top of a trench, a critical dimension at the bottom of the trench, a slope of the sidewall of the trench, a critical dimension at the top of a contact, a critical dimension at the bottom of the contact, and the slope of the sidewall of the contact.

31. The method as recited in claim 18, wherein said process tool controller is configured to minimize said difference using a Newton-Rhapson technique.

32. A semiconductor manufacturing system for performing a process comprising:

a process tool for executing said process; and

a process tool controller coupled to said process tool, wherein said process tool controller further comprises,

a process recipe controller configured to set and adjust process control input data for said process, and set target process control output data to a target result of the process, and

a process model coupled to said process recipe controller and configured to provide a relationship between said process control input data and said process control output data,

said process recipe controller configured to generate new process control input data by minimizing a difference between said target process control output data and process control output data predicted by said relationship applied to said new process control input data.

33. The system as recited in claim 32, further comprising:

a metrology tool coupled to said process tool controller and coupled to said process tool,

wherein said metrology tool is configured to measure process control output data for said process and provide said measured process control output data to said process tool controller for updating said process model.

34. The system as recited in claim 32, wherein said process tool comprises at least one of an etch process tool, a deposition process tool, a spin coating process tool, and a thermal processing system tool.

35. A graphical user interface (GUI) for utilizing a process model to predict process control output data from process control input data, comprising:

means for entering an input change to at least one parameter in said process control input data using at least one delta field in said GUI;

means for executing said process model to determine an output change in at least one parameter of said process control output data using said input change; and

means for displaying said output change in an output field in said GUI.

36. The GUI as recited in claim 35, wherein said process model is a partial least squares (PLS) model.

37. A graphical user interface (GUI) for optimizing process control input data to achieve target process control output data using a process model, comprising:

means for entering a target change to at least one parameter in said process control output data;

means for executing said process model to optimize an input change to at least one parameter in said process control input data by using said target change; and

means for displaying said input change in a delta field in said GUI.

38. The GUI as recited in claim 37, wherein said process model is a partial least squares (PLS) model.

39. A computer readable medium containing program instructions for execution on a computer system controlling a semiconductor manufacturing system, which when executed by the computer system, cause the computer system to perform the steps of:

setting process control input data for said process in said semiconductor manufacturing system;

measuring process control output data from said process in said semiconductor manufacturing system;

determining a relationship between said process control output data and said process control input data;

setting target process control output data to a target result of the process; and

calculating new process control input data by minimizing a difference between said target process control output data and predicted process control output data, wherein said predicted process control output data is determined using said relationship applied to said new process control input data.

40. The medium of Claim 39, further containing said program instructions to perform the step of:

updating said relationship between said process control input data and said process control output data.

41. The medium of Claim 40, further containing said program instructions to perform the step of:

using an exponentially weighted moving average (EMWA) filter.

42. The medium of Claim 39, wherein said calculating in the program instructions comprises:

weighing said process control input data prior to calculating said new process control input data.

43. The medium of Claim 39, wherein said calculating in the program instructions comprises:

weighing said process control output data prior to calculating said new process control input data.

44. The medium of Claim 39, further containing said program instructions to perform the step of:

minimizing a difference between said process control input data and said new process control input data.

45. The medium of Claim 39, wherein said determining in the program instructions comprises:

developing said relationship with a process model developed using partial least squares (PLS) analysis.

46. The medium of Claim 39, further containing said program instructions to perform the step of:

developing said wherein said relationship with a multiple input multiple output (MIMO) process model.

47. The medium of Claim 46, wherein said developing in the program instructions comprises:

developing an MIMO process model characterized by $\underline{Y} = f(\underline{X}) + \underline{C}$, wherein $\underline{Y}$ comprises process control output data, $\underline{X}$ comprises process control input data, $\underline{C}$ comprises an array of constants, and $f(\ )$ represents a function of $\underline{X}$.

48. The medium of Claim 47, wherein said function $f(\ )$ represents a linear function.

49. The medium of Claim 47, wherein said function $f(\ )$ represents a nonlinear function.

50. The medium of Claim 39, further containing said program instructions to perform the step of:

setting said process input data for an etch process.

51. The medium of Claim 39, wherein said setting in the program instructions comprises:

setting said process control input data for least one of a RF power, a pressure, a fluid flow rate, a temperature, a rotation rate, and a composition.

52. The medium of Claim 51, wherein said setting in the program instructions comprises:

setting said process control input data including at least one of a RF power, a pressure, a C_4F_8 flow rate, a CO flow rate, and a O_2 flow rate.

53. The medium of Claim 39, wherein said measuring process control output data in the program instructions comprises:

measuring said process control output data including at least one of a critical dimension, a slope, a profile, an etch rate, an etch depth, a deposition rate, and a film thickness.

54. The medium of Claim 51, wherein said measuring process control output data in the program instructions comprises:

measuring at least one of a critical dimension at the top of a trench, a critical dimension at the bottom of the trench, a slope of the sidewall of the trench, a critical dimension at the top of a contact, a critical dimension at the bottom of the contact, and the slope of the sidewall of the contact.

55. The medium of Claim 39, wherein said calculating in the program instructions comprises:

minimizing said difference using a Newton-Rhapson technique.